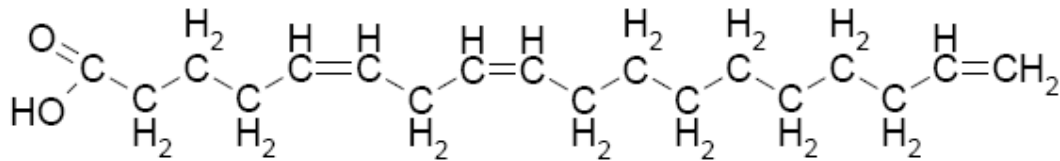


**Ch6: Cell membranes**

1. Which molecules make up the structure of cell membranes?

*Amphiphilic lipids (mainly phospholipids) and proteins. Carbohydrates are bound to the lipids and proteins and are not an intrinsic part of the membrane structure.*

2. (Ch 3). Sketch a C18-fatty acid that has unsaturated bonds between C5-C6, C8-C9 and C17-C18.

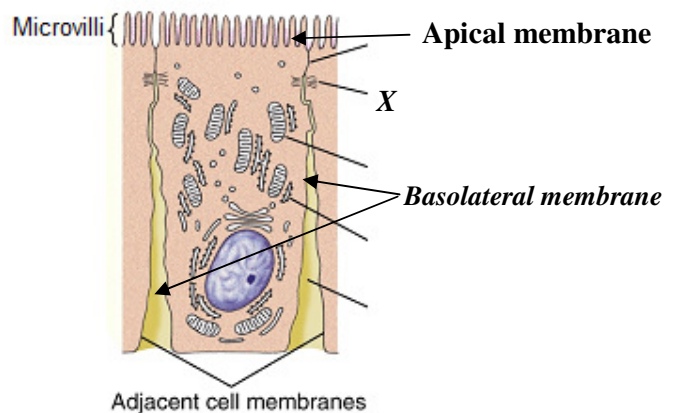


3. Which of the following amino acids would you expect to find in the section of a membrane protein that passes through the membrane: Lys, Glu, Tyr, Ile? Explain your answer.

*Since the part of the protein that crosses the membrane must be hydrophobic, it would be expected to find amino acids with hydrophobic side chains. Of these four, only isoleucine (Ile) is hydrophobic.*

4. The tissue lining the inside of our gut is called the gut epithelium and is built up of epithelial cells. To ensure that the gut contents cannot bypass the epithelial cells and pass into the bloodstream, these cells are sealed to each other by one of the three "cell junctions" mentioned in Ch6. Which type of junction is this, and how is it built up?

*Tight junction – for the structure see Fig 6.7A p. 112*



5. How can glucose be transported into a cell across the plasma membrane, when glucose is unable to pass a lipid bilayer, and the glucose concentration is higher inside the cell than outside?

*Glucose can be taken up by cells using a carrier protein that functions by symport.  $\text{Na}^+$  ions are taken up together with glucose. Since  $\text{Na}^+$  ions have a much higher concentration outside the cell than inside, this transport drives the uptake of glucose. fig. 6.17 p. 122*

6. Phospholipids are often represented as "a ball with two tails" as in the sketch below. Which part of the phospholipid molecule is represented by

a) the "ball"



b) the "tails"

*the ball represents the polar part of the molecule that contains the phosphate group. The tails represent the hydrophobic fatty acid chains.*

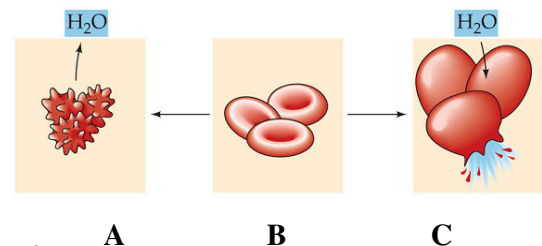
**7.** What effect on membrane function do double bonds in the fatty acid chains of membrane lipids have?

*The double bonds make the membrane more fluid. This is because cis-double bonds cause a bend in the fatty acid chain, which means that unsaturated fatty acids cannot pack as tightly together as saturated fatty acids. The resulting weaker Van der Waals interactions allow more movement in the membrane.*

**8.** What are the characteristics of transmembrane proteins?

*They are made up of two hydrophilic regions, one on each side of the membrane, connected by one or more hydrophobic spans that cross the lipid bilayer. fig. 6.3 p. 108*

**9.** The figure on the right illustrates what would happen, if a red blood cell was placed in a solution with A) high (hypertonic) salt concentration B) the same salt concentration (isotonic) as within the cell or C) a very low (hypotonic) salt concentration.



Which property of the membrane is responsible for the changes in cell shape that occur in these different solutions?

*The membrane is semipermeable –water, but not ions, can pass through. This means that water moves across the membrane to equalize the salt concentration on either side (osmosis).*

**10.** What role of the carbohydrates that are bound to membrane proteins?

*Carbohydrates are important for recognition by specific molecules. -Carbohydrates are therefore important for cellular recognition. Carbohydrate structures also form the basis for recognition in ABO blood types*

**11.** Give three important functions of the plasma membrane for cells.

1. Separation of internal and external environment, maintaining concentration differences by means of selective permeability and active transport.
2. Processing of information (fig 6.20 C p. 125)
3. Energy transformation (fig 6.20 A p. 125)
4. Organisation of chemical reactions (fig 6.20B p. 125)

**12.** What is the role of cholesterol in plasma membranes?

*Cholesterol regulates membrane fluidity in both directions. On the one hand, cholesterol interferes with free movement of the phospholipids in the membrane, decreasing the fluidity. On the other hand, cholesterol destabilizes the packing of long fatty acid chains in crystalline (solid) regions, thereby reducing the melting temperature of the membrane. Cholesterol is often found concentrated in semi-fluid regions of the membrane called "lipid rafts"*

**13. Which factors affect membrane fluidity?**

1. *Fatty acid composition: more unsaturated fatty acids give increased fluidity. Shorter fatty acid chains give more fluidity*
2. *Temperature: Higher temperature increases fluidity*
3. *Cholesterol reduces fluidity*

**14. Describe at least three functions of proteins in the plasma membrane.**

1. *Transport proteins:*
  - a. *Ion channels, fig. 6.11 p. 117*
  - b. *Carriers, fig. 6.14 p. 120*
  - c. *Active transporters, fig. 6.15-6.17 p. 121-122*
2. *Cell recognition and adhesion, fig. 6.6 p. 111*
3. *Receptors for molecules, fig 6.20 C p. 125*
4. *Enzymes: catalysis of chemical reactions, fig. 6.20 B p. 125*
5. *Energy transformation, fig 6.20 A p. 125*

**15. Define the following terms:**

**A) Endocytosis:**

*General term to describe the uptake of macromolecules, large particles and small molecules/cells into a eukaryotic cell by formation of intracellular vesicles.*

**B) Exocytosis:**

*Release of molecules or large particles to the surroundings, via fusion of an intracellular vesicle with the plasma membrane.*

**C) Phagocytosis:**

*An example of endocytosis, where part of the plasma membrane forms an intracellular vesicle that contains large particles or whole cells, engulfed from the surroundings.*

*Phagocytosis is also called "cell eating".*

**D) Pinocytosis:**

*An example of endocytosis, where part of the plasma membrane forms an intracellular vesicle that contains small dissolved molecules or liquid taken up from the surroundings.*

*Pinocytosis is also called "cell drinking".*

**16. Which factors determine whether a molecule can pass the plasma membrane?**

- 1) *Size: small molecules cross more easily*
- 2) *Hydrophobicity: hydrophobic, non-polar, uncharged molecules cross more easily,*
- 3) *Presence of transport proteins that allow passage of specific molecules*

**17. Diabetics sometimes have an increased risk of blood clots as the cells in their artery linings are often shrunken and loose. What can be the reason for the cells shrinking?**

*Diabetics have increased blood sugar levels and the osmotic pressure causes water to be pressed out of the cells, which therefore shrink. Cells in this state are less resistant and are easily torn away from the artery wall, causing blockage of the artery.*

**18.** A patient has become dehydrated and needs water urgently. You choose to apply an intravenous drip. What will happen if you give pure, distilled water via the drip?

*You create an osmotic pressure on the blood cells. causing them to swell as the water is pressed into the cells. There is a risk of the blood cells bursting, with serious consequences. For this reason, water with a certain amount of salt is applied.*

**Exam dec 05.** What is the difference between primary and secondary active transport?

*Primary active transport: the energy for transport is obtained directly from e.g. ATP hydrolysis.*

*In secondary active transport, the energy for transport is obtained by exploiting an ion gradient across the membrane, which has been generated by primary active transport.*